

**What is claimed is:**

1. An alkaline peroxide mechanical pulping process comprising the steps of:

- 5           feeding a lignocellulosic material into a first press;  
          pressing the lignocellulosic material;  
          discharging the lignocellulosic material from the first press;  
          impregnating the lignocellulosic material discharged from the first  
press with a first alkaline peroxide pretreatment solution and maintaining  
10       the impregnation for a first reaction time;  
          feeding the impregnated lignocellulosic material to a refiner having  
an inlet and a rotating disc within a superatmospheric casing;  
          refining the impregnated lignocellulosic material to form a primary  
pulp having a temperature of at least about 80C;  
15       delivering a stream of primary pulp from the superatmospheric  
casing to an intermediate line while the primary pulp temperature is at  
least about 80C;  
          adding an alkaline peroxide intermediate line solution to the  
stream of primary pulp within the intermediate line while the primary pulp  
20       temperature is at least about 80C;  
          mixing the intermediate line solution and the stream of primary  
pulp to form a reaction mixture in the intermediate line;  
          discharging the reaction mixture having a temperature of at least  
about 80C into a retention vessel;  
25       retaining the reaction mixture in the retention vessel to produce a  
bleached material.

2. The alkaline peroxide mechanical pulping process of claim 1 further comprising;

- 30       feeding the lignocellulosic material that has been impregnated with  
the first pretreatment solution for a first reaction time, into a second  
press;  
          pressing and discharging the lignocellulosic material from the  
second press;

impregnating the lignocellulosic material discharged from the second press with a second alkaline peroxide pretreatment solution and maintaining the second impregnation for a second reaction time.

- 5           3.       The alkaline peroxide mechanical pulping process of claim 1 further comprising adding an alkaline peroxide refiner solution to the lignocellulosic material at the refiner.
- 10           4.       The alkaline peroxide mechanical pulping process of claim 1, wherein the step of feeding the impregnated lignocellulosic material to a refiner having an inlet and a rotating disc within a superatmospheric casing includes maintaining the superatmospheric casing at a pressure of at least about 240kPa.
- 15           5.       The alkaline peroxide mechanical pulping process of claim 1, wherein the step of mixing is immediately followed by introducing the mixture into a separator and the separated pulp is then discharged into said retention vessel.
- 20           6.       The alkaline peroxide mechanical pulping process of claim 1, wherein the step of adding an alkaline peroxide intermediate line solution to the stream of primary pulp within the intermediate line includes adding the intermediate line solution immediately after a blow valve.
- 25           7.       The alkaline peroxide mechanical pulping process of claim 5, wherein the step of adding an alkaline peroxide intermediate line solution to the stream of primary pulp within the intermediate line includes adding the intermediate line solution immediately prior to the separator.
- 30           8.       The alkaline peroxide mechanical pulping process of claim 1, wherein the step of delivering a stream of primary pulp from the superatmospheric casing to a intermediate line further includes the primary pulp having a temperature in the range of about 90C to about 155C and a consistency of about 20 to about 60%.

9. The alkaline peroxide mechanical pulping process of claim 1, wherein the reaction mixture is retained in the retention vessel at a temperature of about 60C to about 95C and a consistency of about 20% to about 40%.

10. The alkaline peroxide mechanical pulping process of claim 1, wherein the reaction mixture is retained in the retention vessel at a temperature of about 85C to about 95C, and a consistency of about 30%.

11. The alkaline peroxide mechanical pulping process of claim 1, wherein the impregnation solution contains alkali, peroxide, and stabilizer; the intermediate line solution contains alkali, peroxide, and stabilizer; and said intermediate line solution has a temperature less than about 80C.

12. The alkaline peroxide mechanical pulping process of claim 2, wherein the first impregnation solution contains 0.3% DTPA; the second impregnation solution contains 0.2% MgSO<sub>4</sub>, 4.4% silicate, 2.8% TA, and 2.8% H<sub>2</sub>O<sub>2</sub>; and the intermediate line solution contains 0.16% DTPA, 0.16% MgSO<sub>4</sub>, 2.3% silicate, 1.8% TA with 0.5% being residual, 2.4% H<sub>2</sub>O<sub>2</sub> with 1.1% being residual.

13. The alkaline peroxide mechanical pulping process of claim 2, wherein the first impregnation solution contains 0.5% DTPA; the second impregnation solution contains 0.2% DTPA, 0.1% MgSO<sub>4</sub>, 2.0% silicate, 1.6% TA, and 2.6% H<sub>2</sub>O<sub>2</sub>; and the intermediate line solution contains 0.13% DTPA, 0.13% MgSO<sub>4</sub>, 2.5% silicate, 1.2% TA with 0.1% being residual, 2.1% H<sub>2</sub>O<sub>2</sub> with 2.1% being residual.

14. The alkaline peroxide mechanical pulping process of claim 2, wherein the first impregnation solution contains 0.3% DTPA, 0.05% MgSO<sub>4</sub>, 0.7% silicate, 0.2% TA, and 0.5% H<sub>2</sub>O<sub>2</sub>; the second impregnation solution contains 0.1% DTPA, 0.08% MgSO<sub>4</sub>, 1.8% silicate,

1.4% TA, and 1.9% H<sub>2</sub>O<sub>2</sub>; and the intermediate line solution contains 0.22% DTPA, 0.11% MgSO<sub>4</sub>, 1.1% silicate, 0.9% TA with 0.2% being residual, 1.2% H<sub>2</sub>O<sub>2</sub> with 1.7% being residual.

5            15.        The alkaline peroxide mechanical pulping process of claim 2, wherein the first impregnation solution contains 0.4% TA, 0.5% H<sub>2</sub>O<sub>2</sub>, 0.2% DTPA, 0.04% MgSO<sub>4</sub>, 0.5% silicate; the second  
10            impregnation solution contains 0.14% DTPA, 0.05% MgSO<sub>4</sub>, 0.5% silicate, 0.4% TA, and 0.6% H<sub>2</sub>O<sub>2</sub>; and the intermediate line solution contains 0.18% DTPA, 0.06% MgSO<sub>4</sub>, 1.8% silicate, 1.2% TA with 0.1% being residual, 1.8% H<sub>2</sub>O<sub>2</sub> with 1.1% being residual.

15            16.        The alkaline peroxide mechanical pulping process of claim 2, wherein the first impregnation solution contains 0.4% TA, 0.6% H<sub>2</sub>O<sub>2</sub>, 0.18% DTPA, 0.03% MgSO<sub>4</sub>, 0.3% silicate; the second  
16            impregnation solution contains 0.15% DTPA, 0.05% MgSO<sub>4</sub>, 0.4% silicate, 0.4% TA, and 0.7% H<sub>2</sub>O<sub>2</sub>; and the intermediate line solution contains 1.7% TA, and 2.8% H<sub>2</sub>O<sub>2</sub> with 1.1% being residual.

20            17.        A chemimechanical pulping process comprising the steps of:  
                 feeding a lignocellulosic material into a first press;  
                 pressing the lignocellulosic material;  
                 discharging the lignocellulosic material from the first press;  
                 impregnating the lignocellulosic material discharged from the first  
25            press with a first chemical bleaching pretreatment solution and maintaining the impregnation for a first reaction time;  
                 feeding the lignocellulosic material impregnated with the first pretreatment solution to a refiner having an inlet and a rotating disc within a superatmospheric casing;  
30            refining the lignocellulosic material to form a primary pulp having a temperature of at least 80°C;  
                 while the primary pulp temperature is at least about 80°C, discharging the primary pulp from the casing to an intermediate line;

while the primary pulp temperature is at least about 80C, adding an alkaline peroxide intermediate line solution at the intermediate line which contains the primary pulp;

mixing the intermediate line solution with the primary pulp;

while the intermediate line solution and primary pulp mixture are at a temperature of at least about 80C discharging the intermediate line solution and primary pulp mixture into a retention tower;

retaining the mixture in the retention tower; and

processing the primary pulp further to a secondary pulp.

18. An alkaline peroxide mechanical pulping process comprising the steps of:

in a primary refiner having a superatmospheric casing, refining a lignocellulosic material that has been pretreated and impregnated with at least a first alkaline peroxide pretreatment solution;

discharging the lignocellulosic material at temperature of at least about 80C into intermediate line having at least one solution inlet port;

injecting an alkaline peroxide intermediate line solution through the at least one solution inlet port;

mixing the intermediate line solution and the lignocellulosic material in the intermediate line;

discharging the lignocellulosic material from the intermediate line at a temperature of at least about 80C; and

maintaining the discharged lignocellulosic material for a reaction period.

19. The alkaline peroxide mechanical pulping process of claim 18, wherein the step of refining further includes adding a refiner solution of alkaline peroxide at the primary refiner.

20. The alkaline peroxide mechanical pulping process of claim 18, wherein the step of injecting an alkaline peroxide intermediate line solution through the at least one solution inlet port and into the intermediate line containing the lignocellulosic material includes injecting

an alkaline peroxide intermediate line solution through, at least, one solution inlet port located immediately after the blow valve.

21. An alkaline peroxide mechanical pulping process comprising the steps of:

feeding a lignocellulosic material into a first press;

pressing the lignocellulosic material;

discharging the lignocellulosic material from the first press;

impregnating the lignocellulosic material discharged from the first press with a first alkaline peroxide pretreatment solution and maintaining the impregnation for a first reaction time;

feeding the impregnated lignocellulosic material to a refiner having an inlet and a rotating disc within a superatmospheric casing;

refining the impregnated lignocellulosic material to form a primary pulp;

discharging the stream of primary pulp from the superatmospheric casing to an intermediate line;

adding an alkaline peroxide intermediate line solution to the stream of primary pulp within the intermediate line;

mixing the intermediate line solution and the stream of primary pulp to form a reaction mixture;

discharging the reaction mixture into a retention vessel;

retaining the reaction mixture in the retention vessel to produce a bleached material.

22. The alkaline peroxide mechanical pulping process of claim 21, further comprising;

feeding the lignocellulosic material that has been impregnated with the first pretreatment solution for a first reaction time, into a second press;

pressing and discharging the lignocellulosic material from the second press;

impregnating the lignocellulosic material discharged from the second press with a second alkaline peroxide pretreatment solution and maintaining the second impregnation for a second reaction time.

5        23.    The alkaline peroxide mechanical pulping process of claim 21 further comprising adding an alkaline peroxide refiner solution to the lignocellulosic material at the refiner.

10       24.    The alkaline peroxide mechanical pulping process of claim 21, wherein the step of discharging the stream of primary pulp from the superatmospheric casing to an intermediate line includes the intermediate line having a blow valve and adding the alkaline intermediate line solution immediately after the blow valve.

15       25.    The alkaline peroxide mechanical pulping process of claim 21, wherein discharging the stream of primary pulp from the superatmospheric casing includes the intermediate line having a blow valve followed by a separator and the step of adding an alkaline peroxide intermediate line solution to the stream of primary pulp within the  
20       intermediate line includes adding the alkaline peroxide intermediate line solution immediately prior to the separator.

25       26.    The alkaline peroxide mechanical pulping process of claim 21, wherein discharging the stream of primary pulp from the superatmospheric casing includes the intermediate line having a blow valve followed by a separator and the step of adding an alkaline peroxide intermediate line solution to the stream of primary pulp within the  
30       intermediate line includes adding the alkaline peroxide intermediate line solution at the separator.

27.    The alkaline peroxide mechanical pulping process of claim 24, wherein discharging the stream of primary pulp from the superatmospheric casing includes the intermediate line having a blow valve followed by a separator and the step of adding an alkaline peroxide

intermediate line solution to the stream of primary pulp within the intermediate line includes adding the alkaline peroxide intermediate line solution immediately after the separator.

5        28. The alkaline peroxide mechanical pulping process of claim 21, wherein the step of feeding the impregnated lignocellulosic material to a refiner having an inlet and a rotating disc within a superatmospheric casing includes maintaining the superatmospheric casing at a pressure of at least about 240kPa.

10       29. The alkaline peroxide mechanical pulping process of claim 21, wherein the impregnation solution contains alkali, peroxide, and stabilizer; the intermediate line solution contains alkali, peroxide and stabilizer; and said intermediate line solution is at a temperature less than  
15       the stream of primary pulp.

30. The alkaline peroxide mechanical pulping process of claim 22, wherein the first impregnation solution contains 0.3% DTPA; the second impregnation solution contains 0.2% MgSO<sub>4</sub>, 4.4% silicate, 2.8% TA, and  
20       2.8% H<sub>2</sub>O<sub>2</sub>; and the intermediate line solution contains 0.16% DTPA, 0.16% MgSO<sub>4</sub>, 2.3% silicate, 1.8% TA with 0.5% being residual, 2.4% H<sub>2</sub>O<sub>2</sub> with 1.1% being residual.

31. The alkaline peroxide mechanical pulping process of claim 22, wherein the first impregnation solution contains 0.5% DTPA; the second  
25       impregnation solution contains 0.2% DTPA, 0.1% MgSO<sub>4</sub>, 2.0% silicate, 1.6% TA, and 2.6% H<sub>2</sub>O<sub>2</sub>; and the intermediate line solution contains 0.13% DTPA, 0.13% MgSO<sub>4</sub>, 2.5% silicate, 1.2% TA with 0.1% being residual, 2.1% H<sub>2</sub>O<sub>2</sub> with 2.1% being residual.

32. The alkaline peroxide mechanical pulping process of claim 22, wherein the first impregnation solution contains 0.3% DTPA, 0.05%  
30       MgSO<sub>4</sub>, 0.7% silicate, 0.2% TA, and 0.5% H<sub>2</sub>O<sub>2</sub>; the second impregnation solution contains 0.1% DTPA, 0.08% MgSO<sub>4</sub>, 1.8% silicate,



1.4% TA, and 1.9% H<sub>2</sub>O<sub>2</sub>; and the intermediate line solution contains 0.22% DTPA, 0.11% MgSO<sub>4</sub>, 1.1% silicate, 0.9% TA with 0.2% being residual, 1.2% H<sub>2</sub>O<sub>2</sub> with 1.7% being residual.

33. The alkaline peroxide mechanical pulping process of claim 22, wherein the first impregnation solution contains 0.4% TA, 0.5% H<sub>2</sub>O<sub>2</sub>, 0.2% DTPA, 0.04% MgSO<sub>4</sub>, 0.5% silicate; the second impregnation solution contains 0.14% DTPA, 0.05% MgSO<sub>4</sub>, 0.5% silicate, 0.4% TA, and 0.6% H<sub>2</sub>O<sub>2</sub>; and the intermediate line solution contains 0.18% DTPA, 0.06% MgSO<sub>4</sub>, 1.8% silicate, 1.2% TA with 0.1% being residual, 1.8% H<sub>2</sub>O<sub>2</sub> with 1.1% being residual.

34. The alkaline peroxide mechanical pulping process of claim 22, wherein the first impregnation solution contains 0.4% TA, 0.6% H<sub>2</sub>O<sub>2</sub>, 0.18% DTPA, 0.03% MgSO<sub>4</sub>, 0.3% silicate; the second impregnation solution contains 0.15% DTPA, 0.05% MgSO<sub>4</sub>, 0.4% silicate, 0.4% TA, and 0.7% H<sub>2</sub>O<sub>2</sub>; and the intermediate line solution contains 1.7% TA, and 2.8% H<sub>2</sub>O<sub>2</sub> with 1.1% being residual.

35. A chemimechanical pulping process comprising the steps of:  
feeding a lignocellulosic material into a press;  
pressing the lignocellulosic material;  
discharging the lignocellulosic material from the press;  
impregnating the lignocellulosic material discharged from the press with a chemical bleaching pretreatment solution;  
feeding the lignocellulosic material impregnated with the pretreatment solution to a refiner having an inlet and a rotating disc within a superatmospheric casing;  
refining the lignocellulosic material to form a primary pulp;  
discharging the primary pulp from the casing through an intermediate line;  
adding an alkaline peroxide solution at the intermediate line to the primary pulp;  
mixing the intermediate line solution with the primary pulp;

delivering the intermediate line solution and primary pulp mixture to a retention tower;

processing the primary pulp from the retention tower, into a secondary pulp.

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36. An alkaline peroxide mechanical pulping process comprising the steps of:

in a primary refiner having a superatmospheric casing, refining a lignocellulosic material that has been pretreated and impregnated with at least a first alkaline peroxide pretreatment solution;

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discharging the lignocellulosic material into an intermediate line having at least one solution inlet port;

injecting an alkaline peroxide intermediate line solution through the at least one solution inlet port;

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mixing the intermediate line solution and the lignocellulosic material;

discharging the lignocellulosic material from the intermediate line; and

retaining the discharged lignocellulosic material for a reaction period.

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37. The alkaline peroxide mechanical pulping process of claim 36, wherein the step of refining further includes adding a refiner solution of alkaline peroxide at the primary refiner.

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38. The alkaline peroxide mechanical pulping process of claim 36, wherein the step of injecting an alkaline peroxide intermediate line solution through the, at least one, solution inlet port and into the intermediate line containing the lignocellulosic material includes injecting an alkaline peroxide intermediate line solution through, at least, one solution inlet port located immediately after a blow valve.

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39. The alkaline peroxide mechanical pulping process of claim 36, wherein the step of injecting an alkaline peroxide intermediate line

solution through the, at least one, solution inlet port and into the intermediate line containing the lignocellulosic material includes injecting an alkaline peroxide intermediate line solution through, at least, one solution inlet port located immediately prior to a separator.

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40. The alkaline peroxide mechanical pulping process of claim 36, wherein the step of injecting an alkaline peroxide intermediate line solution through the, at least one, solution inlet port and into the intermediate line containing the lignocellulosic material includes injecting an alkaline peroxide intermediate line solution through, at least, one solution inlet port located at a separator.

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41. The alkaline peroxide mechanical pulping process of claim 36, wherein the step of injecting an alkaline peroxide intermediate line solution through the, at least one, solution inlet port and into the intermediate line containing the lignocellulosic material includes injecting an alkaline peroxide intermediate line solution through, at least, one solution inlet port located at a discharge portion of a separator.

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42. An alkaline peroxide mechanical pulping process comprises the steps of:

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in a refiner having a casing, additionally refining a lignocellulosic based

material that has been previously pretreated and impregnated with at least a first alkaline peroxide pretreatment solution and which has been previously refined;

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discharging the lignocellulosic based material into an intermediate line having at least one solution inlet port;

injecting an alkaline peroxide intermediate line solution through the at least one solution port;

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mixing the intermediate line solution and the lignocellulosic based material;

discharging the lignocellulosic based material from the intermediate line; and

retaining the discharged lignocellulosic based material for a reaction period.

5      43.    The alkaline peroxide mechanical pulping process of claim 42,  
wherein the refiner casing is superatmospheric.